APPENDIX 4—AIR QUALITY IMPACT TECHNICAL SUPPORT DOCUMENT

The following technical support document describes the processes used to conduct the air quality impact assessment for the air resources in the Rawlins Resource Management Plan Planning Area (RMPPA), and provides summaries of relevant analysis data. This document will serve as the basis for subsequent air quality impact analyses of other alternatives and the preferred alternative. The contents of this document are as follows:

- Regulatory Framework
- Agency Roles and Authorities
- Existing Air Quality
- Air Quality Impact Analysis
- Emission Calculations
- Internet Resources
- Mitigation

Copies of this technical support document and any data files are available upon request from—

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REGULATORY FRAMEWORK

For quantitative analysis, the following air quality criteria apply. Although criteria listed below do not apply to the qualitative analysis presented in the Rawlins Air Quality Analysis, they are identified here for reference purposes. The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA) and its amendments, and the 1999 Regional Haze Regulations. The CAA addresses criteria air pollutants, State and national ambient air quality standards for criteria air pollutants, and the Prevention of Significant Deterioration program. The Regional Haze Regulations address visibility impairment.

Ambient Air Quality Constituents

Air pollutants addressed in this study include criteria pollutants; hazardous air pollutants (HAP); and sulfur and nitrogen compounds, which could cause visibility impairment or atmospheric deposition impacts.

Criteria Pollutants

Criteria pollutants are those for which national standards of concentration have been established. Ambient air concentrations of these constituents greater than the standards represent a risk to human health. Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), particulate matter (PM_{10}, $PM_{2.5}$), and lead (Pb).

Carbon Monoxide. CO is an odorless, colorless gas formed during any combustion process, such as operation of engines, fireplaces, and furnaces. High concentrations of CO affect the oxygen-carrying capacity of the blood and can lead to unconsciousness and asphyxiation. Wildfires are natural sources of CO.

Nitrogen Dioxide. NO_2 is a red-brown gas formed during operation of internal combustion engines. Such engines emit a mixture of nitrogen gases, collectively called nitrogen oxides (NO_x). NO_x can contribute to brown cloud conditions and can convert to ammonium nitrate particles and nitric acid, which can cause visibility impairment and acid rain. Bacterial action in soil can be a natural source of nitrogen compounds.

Sulfur Dioxide. SO_2 forms during combustion from trace levels of sulfur in coal or diesel fuel. It can convert to ammonium sulfate ($(NH_4)_2SO_4$) and sulfuric acid (H_2SO_4), which can cause visibility impairment and acid rain. Volcanoes are natural sources of SO_2. Anthropogenic sources include refineries and power plants.

Ozone. O_3 is a gas that is generally not emitted directly into the atmosphere but is formed from NO_x and volatile reactive organic compound (VOC) emissions. As stated above, internal combustion engines are the main source of NO_x. Volatile organic compounds, such as terpenes, are very reactive. Sources of VOCs include, but are not limited to, paint, varnish, and some types of vegetation. The faint acrid smell common after thunderstorms is caused by ozone formation by lightning. O_3 is a strong oxidizing chemical that can burn lungs and eyes, and damage plants.

Particulate Matter. Particulate matter (e.g., soil particles, hair, pollen) is essentially small particles suspended in the air that settle to the ground slowly and may be re-suspended if disturbed. Separate allowable concentration levels for particulate matter are based on the relative size of the particle:

- PM_{10} particles, particles with diameters of less than 10 micrometers, are small enough to be inhaled and can cause adverse health effects.
- $PM_{2.5}$ particles, particles with diameters of less than 2.5 micrometers, are so small that they can be drawn deeply into the lungs and cause serious health problems. Particles in this size range are also the main cause of visibility impairment.

Lead. Before use of unleaded fuel for automobiles became widespread, lead particles were emitted from automobile tailpipes. Lead is not considered in this environmental impact statement (EIS) because no proposed projects are expected to emit lead. The lead standard also will not be addressed in this Technical Support Document because lead is not a current concern, but it will be considered in future projects.

Hazardous Air Pollutants

There are a wide variety of HAPs, including N-hexane, ethylbenzene, toluene, xylene, formaldehyde, and benzene. Although HAPs do not have ambient air quality standards, the U.S. Environmental Protection Agency (EPA) has issued reference concentrations for evaluating the inhalation risk for cancerous and noncancerous health effects, known as Reference Concentrations for Chronic Inhalation (RfC).

The EIS associated with the Rawlins resource management plan (RMP) is a National Environmental Policy Act (NEPA) document and not a regulatory document, but the Record of Decision is binding and a "public record" (see 40 CFR 1505.2). Additionally, there are regulatory issues that should be taken into account in preparing this EIS and ensuing project-specific EISs. Actual regulation of HAPs is achieved through compliance with the applicable maximum achievable control technology (MACT) standards and not through ambient air quality standards. Regulatory agencies implement control through Section 112 programs, specifically Section 112(g) case-by-case MACT determinations based on 40 Code of Federal Regulations (CFR) Part 63, Subpart B and Section 112(d) MACT emission standards.

Any source that emits or has the potential to emit 10 tons per year or more of any HAP or 25 tons per year or more of any combination of HAPs is considered a major source and will require a Title V, Part 70 operating permit review and permit. This may include either a case-by-case 112(g) MACT determination, if the source is new or has had major modifications and no applicable MACT emission standard has been promulgated, or compliance with an applicable MACT emission standard. Specific regulations that apply in the Rawlins RMPPA include 40 CFR Part 63 Subpart HH, National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities; 40 CFR Part 63 Subpart HHH, National Emission Standards for Hazardous Air Pollutants From Natural Gas Transmission and Storage Facilities; and 40 CFR Part 63 Subpart ZZZ, National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines. This last regulation, new in 2004, affects source categories using reciprocating engines for gas compression.

For quantifiable analysis, short-term (1-hour) HAP concentrations would be compared to acute Reference Exposure Levels (RELs). RELs are defined as concentrations at or below which no adverse health effects are expected. If no RELs were available for ethylbenzene and n-hexane, the available Immediately Dangerous to Life or Health (IDLH) values would be used. These IDLH values are determined by the National Institute for Occupational Safety and Health (NIOSH) and would be obtained from EPA's Air Toxics Database.

For quantifiable analysis, long-term exposure to HAPs emitted by the Proposed Action would be compared to RfCs. An RfC is defined by EPA as the daily inhalation concentration at which no long-term adverse health effects are expected. RfCs exist for both noncarcinogenic and carcinogenic effects on human health. Annual modeled HAP concentrations for all HAPs emitted would be compared directly to the noncarcinogenic RfCs. RfCs for the suspected carcinogens benzene and formaldehyde are expressed as risk factors. Accepted methods of risk assessment would be used to evaluate the incremental cancer risk from these pollutants.

Annual modeled concentrations would be multiplied by EPA's unit risk factors (URF) (based on 70-year exposure) for those pollutants, and then the product would be multiplied by an adjustment factor, which represents the ratio of projected exposure time to 70 years. The adjustment factors represent two scenarios: a most likely exposure (MLE) scenario and one reflective of the maximally exposed individual (MEI).

The MLE duration would be assumed to be 9 years, which corresponds to the mean duration that a family remains at a residence. This duration corresponds to an adjustment factor of 9/70 = 0.13. The duration of exposure for the MEI is assumed to be 50 years (i.e., the Life of Project [LOP]), corresponding to an adjustment factor of 50/70 = 0.71.

A second adjustment would be made for time spent at home versus time spent elsewhere. For the MLE scenario, the at-home time fraction is 0.64 (EPA 1993), and it would be assumed that during the rest of the day the individual remained in an area where annual HAP concentrations were one quarter as high as the maximum annual average concentration. Therefore, the MLE adjustment factor would be (0.13) x [(0.64 x 1.0) + (0.36 x 0.25)] = 0.0949. The MEI scenario would assume that the individual was at home 100 percent of the time, for a final adjustment factor of (0.71 x 1.0) = 0.71.

HAP emissions are associated with industrial activities, such as oil and gas operations, refineries, paint shops, dry cleaning facilities, and wood working shops.

Because this analysis is qualitative, no specific analysis of either short- or long-term HAP impacts is made.

HAP emissions in the RMPPA are expected to be similar to those found in the Desolation Flats EIS and comprise of benzene, toluene, ethylbenzene, xylene, n-hexane, and formaldehyde.

Atmospheric Deposition Constituents

Sulfur and nitrogen compounds that can be deposited in terrestrial and aquatic ecosystems include nitric acid (HNO_3), nitrate (NO_3^-), ammonium (NH_4^+), and sulfate (SO_4^{--}). Nitric acid (HNO_3), and nitrate (NO_3^-) are not emitted directly into the air but form in the atmosphere from industrial and automotive emissions of NO_x. Sulfate (SO_4^{--}) is formed in the atmosphere from industrial emission of sulfur dioxide (SO_2). Deposition of HNO_3, NO_3^-, and SO_4^{--} can adversely affect plant growth, soil chemistry, lichens, aquatic environments, and petroglyphs. Ammonium (NH_4^+) is primarily associated with feedlots and agricultural fertilization. Deposition of NH_4^+ can affect terrestrial and aquatic vegetation. Although deposition may be beneficial as a fertilizer, it can adversely affect the timing of plant growth and dormancy.

Although this analysis will be qualitative, future specific projects will require quantitative analyses using the following criteria.

Wyoming and National Ambient Air Quality Standards

Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based standards for the maximum concentration of air pollutants at all locations to which the public has access. The WAAQS and NAAQS are legally enforceable standards. Concentrations above the WAAQS and NAAQS represent a risk to human health. State standards must be as strict as, or more strict than, federal standards.

EPA has developed standards for each criteria pollutant for a specific averaging time (see Table A4-1). Short averaging times (1, 3, and 24 hours) address short-term exposure while the annual standards address long-term exposure. Longer term standards are set to lower allowable concentrations than are short-term standards to recognize the cumulative effects of long-term exposure.

Prevention of Significant Deterioration

The goal of the Prevention of Significant Deterioration (PSD) program is to ensure that air quality in areas with clean air does not significantly deteriorate, while maintaining a margin for future industrial growth. Under PSD, each area in the United States is classified by the air quality in that region according to the following system:

- **PSD Class I Areas.** Areas with pristine air quality, such as wilderness areas, national parks, and some Indian reservations, are accorded the strictest protection. Only very small incremental increases in pollutant concentrations are allowed in order to maintain the very clean air quality in these areas.

- **PSD Class II Areas.** Essentially, all areas that are not designated as Class I are designated as Class II. Moderate incremental increases in pollutant concentrations are allowed, although the concentrations are not allowed to reach the concentrations set by Wyoming and federal standards (WAAQS and NAAQS).

- **PSD Class III Areas.** No areas have yet been designated as Class III. Concentrations would be allowed to increase all the way to the WAAQS and NAAQS.

The incremental increases allowed for specific pollutants in Class I and Class II areas are provided in Table A4-2.

Comparisons of potential PM_{10}, NO_2, and SO_2 concentrations with PSD increments are intended only to evaluate a threshold of concern and do not represent a regulatory PSD increment consumption analysis. Regulatory PSD increment consumption analyses are solely the responsibility of the State of Wyoming, which has been granted primacy (with EPA oversight) under the CAA.

In project-specific EISs, the Bureau of Land Management (BLM) does not expect that a PSD analysis will be performed. Rather the PSD standards are used only as a reference to give the public a better understanding of the level of potential impact.

Regional Haze Regulations

Visibility impairment in the form of regional haze obscures the clarity, color, texture, and form of what we see. Haze-causing pollutants (mostly fine particles) are directly emitted into the atmosphere or are formed when gases emitted into the air form particles as they are carried downwind. Emissions from human-caused and natural sources can be carried great distances, contributing to regional haze. The Wyoming Department of Environmental Quality–Air Quality Division (WDEQ-AQD) submitted its Regional Haze State Implementation Plan (SIP) in accordance with 40 CFR, Part 51.309, in December 2003. EPA has not yet taken action on this SIP.

Visual range, one of several ways to express visibility, is the furthest distance at which a person can distinguish a dark landscape feature from a light background like the sky. Without human-caused visibility impairment, natural visual range is estimated to average about 110–115 miles in the western United States and 60–80 miles in the eastern United States (Malm 1999).

The Regional Haze Regulations were developed by EPA in response to the CAA Amendments of 1977 and 1990. They are intended to maintain visibility on the least impaired days and to improve visibility on the most impaired days in mandatory federal Class I areas across the United States so that visibility in these areas is returned to natural conditions by the year 2064. These regulations require states to submit a regional haze SIP and progress reports to demonstrate reasonable progress toward the 2064 goal.

Table A4-1. National and Wyoming Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS			WAAQS		
		(µg/m3)	(ppm)	(ppb)	(µg/m3)	(ppm)	(ppb)
Carbon Monoxide CO	1 hour	40,000	35	35,000	40,000	35	35,000
	8 hour	10,000	9	9,000	10,000	9	9,000
Lead Pb	Calendar quarter	1.5			1.5		
Nitrogen Dioxide NO_2	Annual	100	.053	53	100	.053	53
Ozone O_3	1 hour	235	.12	120	235	.12	120
	8 hour	157	.08	80	157	.08	80
Particulate Matter PM_{10}	24 hour	150			150		
	Annual	50			50		
Particulate Matter $PM_{2.5}$	24 hour	65			65		
	Annual	15			15		
Sulfur Dioxide SO_2	3 hour	1300	.5	500	695	.266	266
	24 hour	365	.14	140	260	.099	99
	Annual	80	.030	30	60	.023	23

Table A4-2. PSD Increments

Pollutant	Averaging Time	PSD Increment					
		Class I			Class II		
		(µg/m3)	(ppm)	(ppb)	(µg/m3)	(ppm)	(ppb)
Nitrogen Dioxide NO_2	Annual	2.5	.0013	1.3	25	.013	13
Particulate Matter PM_{10}	24 hour	8			30		
	Annual	4			17		
Sulfur Dioxide SO_2	3 hour	25	.0096	9.6	512	.1956	196
	24 hour	5	.0019	1.9	91	.0348	35
	Annual	2	.0008	.8	20	.0076	8

APPLICABILITY TO THE RAWLINS AREA

Air pollution impacts are limited by local, state, tribal, and federal air quality regulations, standards, and implementation plans established under the CAA and administered by the WDEQ-AQD with oversight from EPA. Air quality regulations require that proposed new, or modified existing, air pollutant emission stationary sources (including oil and gas compression facilities) undergo a permitting review before their construction can begin. Therefore, the WDEQ-AQD has the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices, before construction or start of operation.

Fugitive dust and exhaust from construction activities, along with air pollutants emitted during operation (e.g., well operations, booster [field] and pipeline [sales] compressor engines), are potential causes of air quality impacts. These issues are more likely to generate public concern where natural gas development activities occur near residential areas or near sensitive Class I and Class II areas.

The Forest Service (FS), the National Park Service (NPS), and the Fish and Wildlife Service (FWS) have also expressed concerns about potential atmospheric deposition (acid rain) and visibility impacts within downwind PSD Class I and PSD Class II sensitive areas under their administration, located throughout Wyoming.

The NAAQS and the WAAQS are health-based standards for the maximum acceptable concentrations of air pollutants at locations to which the public has access. The analysis of the proposed alternatives must demonstrate continued compliance with all applicable local, state, tribal, and federal air quality standards. Existing air quality throughout the project area is in attainment of all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in Table A4-3.

Air quality regulations require that stationary proposed new, or modified existing air pollutant emission sources (including oil and gas compression facilities) undergo a permitting review before their construction can begin. Therefore, the WDEQ-AQD has been given primary authority over and responsibility for reviewing permit applications and for requiring emission permits, fees, and control devices, before construction and/or operation. In addition, the U.S. Congress (through the CAA Section 116) authorized local, state, and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Also, under both the Federal Land Policy and Management Act (FLPMA) and the CAA, BLM cannot authorize any activity that would not conform to all applicable local, state, tribal, and federal air quality laws, regulations, standards, and implementation plans.

Given the project area's current attainment status, future development projects that have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a site-specific regulatory PSD increment consumption analysis under the federal New Source Review permitting regulations. Development projects that require PSD permits may also be required by the applicable air quality regulatory agencies to incorporate additional emission control measures (including a Best Available Control Technology [BACT] analysis and determination) to ensure protection of air quality resources and to demonstrate that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, PM_{10}, and SO_2. Minor sources having emissions below the cutoff rates mentioned above do not require PSD permits; nevertheless, their emissions consume increment.

A regulatory PSD increment consumption analysis may be conducted, either as part of a New Source Review or independently. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. In addition, an analysis of cumulative impacts due to all existing sources and the permit applicant's sources is required during New Source Review to demonstrate that applicable ambient air quality standards will be met during the operational lifetime of the permit applicant's operations.

Sources subject to the PSD permit review procedure are also required to demonstrate potential impacts on air quality–related values (AQRV). These include visibility impacts, degradation of mountain lakes due to atmospheric deposition (acid rain), and effects on sensitive flora and fauna in Class I areas. The CAA also provides specific visibility protection procedures for the mandatory federal Class I areas designated by the U.S. Congress on August 7, 1977, which included wilderness areas greater than 5,000 acres in size, as well as national parks and national memorial parks greater than 6,000 acres in size as of that date.

AGENCY ROLES AND AUTHORITIES

EPA

EPA administers the Federal CAA (42 U.S. Code [U.S.C.] 7401 et seq.) to maintain the NAAQS that protect human health and to preserve the rural air quality in the region by ensuring the PSD Class I and Class II increments for SO_2, NO_2, and PM_{10}, are not exceeded. EPA has delegated this CAA authority to the State of Wyoming.

Wyoming DEQ

Wyoming regulates pollutants emitted into the air through the Wyoming Environmental Quality Act (W.S. 35-11-101 et seq.). Wyoming is also authorized by an approved SIP to administer all requirements of the PSD permit program under the CAA. In addition, the approved Wyoming SIP contains a number of programs that provide for the implementation, maintenance, and enforcement of the NAAQS, including a New Source Review program for minor source permitting that requires, among other things, application of BACT for all new or modified sources, regardless of size or source category. Included as well are authorities for the control of particulate emissions, including fugitive particulate emissions from haul roads, access roads, or general facility boundaries. Wyoming is also delegated responsibility for operating an approved ambient air quality monitoring network for the purpose of demonstrating compliance with the NAAQS and the WAAQS.

Bureau of Land Management

NEPA requires that federal agencies consider mitigation of direct, indirect, and cumulative impacts during their preparation of an EIS (BLM Land Use Planning Manual 1601). Under the CAA, federal agencies are to comply with SIPs regarding the control and abatement of air pollution. Before approval of RMPs or amendments to RMPs, the state director is to submit any known inconsistencies with SIPs to the governor of that state. If the governor of the state recommends changes in the proposed RMP or amendment to meet SIP requirements, the state director shall give the public an opportunity to comment on those recommendations. (BLM Land Use Planning Manual, Section 1610.3-2.)

Forest Service

The FS administers national forests, which include several wilderness areas (WA) that could be affected by direct effects associated with the project: Bridger WA; Fitzpatrick WA; Rawah WA; and Mount Zirkel WA with mandatory federal Class I designation. In addition, Washakie, Teton, and Savage Run WAs and the Class II Popo Agie must be included in the RMPPA analysis. As federal land mangers, the USFS could act in a consultative role to recommend that the BLM impact analysis results, or any future EPA- or state-administered PSD refined impact analysis results (if justified), trigger adverse impairment status. If the FS determines impairment of WAs, BLM, the state, and/or EPA might need to mitigate this predicted adverse air quality effect.

National Park Service

One area administered by the NPS with a mandatory federal Class I area designation, Rocky Mountain National Park, could be affected by direct effects associated with the Rawlins Field Office BLM emissions. As federal land mangers, the NPS could act in a consultative role to recommend that the BLM impact analysis results, or any future EPA- or state-administered PSD refined impact analysis results (if justified), trigger adverse impairment status. If the NPS determines impairment of NPS-administered Class I areas, BLM, the state, and/or EPA might need to mitigate this predicted adverse air quality effect.

EXISTING AIR QUALITY

As described in Chapter 3.2, Affected Environment (Air Resources), specific air quality monitoring is not conducted throughout most of the project area, but air quality conditions are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Table A4-3 summarizes the ambient air quality background concentrations in the RMPPA. This information was provided by WDEQ. Although monitoring is primarily conducted in urban or industrial areas, the data selected are considered to be the best available representation of background air pollutant concentrations throughout the project area. The assumed background pollutant concentrations are below applicable ambient air quality standards for all pollutants and averaging times (although ozone levels approach the standards). These national and Wyoming standards, and PSD increment values are also presented in Tables A4-1 and A4-2.

Table A4-3. Assumed Background Concentrations and Applicable Ambient Air Quality Standards and PSD Increment Values (in µg/m^3)

Averaging Time	Measured Background Concentration (µg/m3)	Percent of Standards (%)		Data Source
		NAAQS	WAAQS	
Carbon Monoxide (CO)				Data collected by Amoco at Ryckman Creek for an 8-month period during 1978–1979, summarized in the Riley Ridge EIS
1-hour	3,336	8	8	
8-hour	1,381	14	14	
Nitrogen Dioxide (NO_2)				Data collected at Green River Basin Visibility Study Site, Green River, Wyoming, during January–December 2001 (ARS 2002)
Annual	3.4	3	3	
Ozone				Data collected at Green River Basin Visibility Study Site, Green River, Wyoming, during June 10, 1998, through December 31, 2001(ARS 2002)
1-hour	169	72	72	
8-hour	147	94	94	
Particulate Matter (PM_{10})				Data collected by WDEQ at Emerson Building, Cheyenne, Wyoming, Year 2002 (WDEQ)
24-hour	47	31	31	
Annual	16	32	32	
Particulate Matter ($PM_{2.5}$)				Data collected by WDEQ at Emerson Building, Cheyenne, Wyoming, Year 2002 (WDEQ)
24-hour	15	23	23	
Annual	5	33	33	
Sulfur Dioxide (SO_2)				Data collected at LaBarge Study Area at the Northwest Pipeline Craven Creek site 1982–1983
3-hour	132	10	19	
24-hour	43	12	17	
Annual	9	11	15	

Data provided by the WDEQ-AQD
Note: µg/m3 = micrograms per cubic meter

Air Quality Impact Assessment

As described in Chapter 4, Environmental Consequences (Air Quality), a qualitative emission comparison approach was used. A qualitative method was selected because of (1) lack of specific project information on location, types, and magnitude of potential projects and (2) time constraints in completing the analysis.

Emissions calculations were based on the best available engineering data and assumptions; air, visibility, and atmospheric deposition data; and emission inventory procedures, as well as on professional and scientific judgment. However, where specific data or procedures were not available, assumptions were incorporated.

Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during well pad construction were used to estimate emissions for $PM_{2.5}$ and PM_{10} impacts. Maximum air pollutant emissions from each oil and gas well would be temporary (i.e., occurring during an average of a 12-day construction period) and would occur in isolation, without significantly interacting with adjacent well locations. Particulate matter emissions from well pad and resource road construction would be minimized by application of water and/or chemical dust suppressants. The control efficiency of these dust suppressants was computed at 50 percent during construction. During well completion testing, natural gas could be burned (flared) on an average of 2 days (refer to emission CD for details).

For any future projects, significance criteria for potential air quality impacts will include local, state, tribal, and federally enforced legal requirements to ensure that air pollutant concentrations remain within specific allowable levels. These requirements and legal limits are presented in Table A4-1. Because neither the WDEQ-AQD nor EPA has established ambient HAP standards, only emissions were calculated.

Because the potential air pollutant emission sources comprise many small sources spread out over a very large area, discrete visible plumes are not likely to impact the distant sensitive areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze degradation is caused by fine particles' and gases' scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change" (1.0 deciview [dv]) in visibility when compared to background conditions. A 1.0 dv change is considered potentially significant in mandatory federal PSD Class I areas as described in the EPA Regional Haze Regulations (40 CFR 51.300 et seq.), and as originally presented in Pitchford and Malm (1994). A 1.0 dv change is defined as about a 10 percent change in the extinction coefficient (corresponding to a 2 to 5 percent change in contrast, for a black target against a clear sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory federal Class I areas.

It should be noted that a 1.0 dv change is not a "just noticeable change" in all cases for all scenes. Visibility changes of less than 1.0 dv are likely to be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution, as in the case of preferential forward light scattering. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the maximum visual range, a change of greater than 1.0 dv might be required to produce a "just noticeable change." However, any future project-specific NEPA analyses will not be designed to predict specific visibility impacts for specific views in specific mandatory federal Class I areas based on specific project designs but to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a preconstruction air quality PSD permit review, the WDEQ-AQD may require a much more detailed visibility impact analysis. Factors such as the magnitude of change, frequency, time of year, and meteorological conditions during times when predicted visibility impacts are above the 1.0 dv threshold (as well as inherent conservatism in the impact analyses) should all be considered in assessing the significance of predicted impacts.

The FS, NPS, and FWS have published their *Final FLAG Phase I Report* (*Federal Register,* Vol. 66, No. 2, January 3, 2001), providing "…a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs…" including visibility. For example, the FLAG report states, "A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed," and further, "If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10% [1.0 dv] for all time periods, the FLMs will not likely object to the proposed action."

Estimation of Emission Factors

For natural gas compressor engines, the emissions of nitrogen oxides, CO, and formaldehyde are determined by the average permitted emission rate allowed by the state under BACT processes. For fugitive dust impacts, emission rates are obtained from EPA's *AP-42* document titled *A Compilation of Air Pollutant Emission Factors*. An *AP-42* emission factor is a representative value that attempts to relate the quantity of a pollutant released into the atmosphere with an activity associated with the release of that pollutant. Emission factors may be appropriate to use in a number of situations, such as in making source-specific emission estimates for areawide inventories. These inventories have many purposes, including ambient dispersion modeling and analysis, control strategy development, and screening sources for compliance investigations. In most cases, these factors are simply averages of all available data of acceptable quality and are generally assumed to be representative of long-term averages for all sources in a specific category.

Emission Assumptions

When reviewing the emission inventory it is important to understand that assumptions were made regarding development. For example, there is uncertainty regarding ultimate development of energy resources (e.g., number of wells, equipment to be used, specific locations of wells).

For the qualitative emission comparison approach, the following assumptions were used:

- All emission sources were assumed to operate at their reasonably foreseeable maximum emission rates (as identified in the other resource sections of this document) simultaneously throughout the area. Given the number of sources included in this analysis, the co-probability of such a scenario actually occurring over an entire year (or even 24 hours) is small.
- In developing the emissions inventory, there is uncertainty regarding ultimate development (e.g., number of wells, equipment to be used, specific locations). All proposed coalbed natural gas and conventional wells were assumed to be fully operational and to remain operating, except for normal well closures throughout the area (well numbers were provided by the BLM RMG Group).
- The emissions inventory uses peak years of construction and peak years of operation, which would not occur throughout the entire development region at the same time. However, it is possible that conditions close to this could occur in some isolated areas. Further, it is assumed that the maximum cumulative emissions will occur in the last year (2023) of the analysis.
- Mitigation measures are included in the emissions inventory that may not be achievable in all circumstances. However, actual mitigation actions decided on by the developers and local and

state authorities may be greater or less than those assumed in the analysis. For example, maintaining a construction road speed limit of 15 miles per hour (mph) might be reasonable in a construction zone but difficult to enforce elsewhere. Full (100 percent) mitigation of fugitive dust from disturbed lands might not be achievable. Further, although 50 percent reduction in fugitive emissions is assumed based on construction road wetting on the unimproved access road to the pad and at the pad, this level of effectiveness is characterized as the maximum possible. Wetting was assumed for maintenance traffic.

- Induced or secondary growth related to increases in vehicle miles traveled (VMT) is not included in the emissions inventory. Only activities directly related to BLM actions are considered.

The major assumptions used in developing the emissions calculations are as follows:

- Except for those emission factors that have been lowered through the WDEQ-AQD BACT requirements, EPA-recommended emission factors (AP-42) are appropriate for all activities
- The base year is 2003
- Activity factors (or the quantification of activity for each resource area as provided by the Rawlins Field Office) are appropriate for the base year and future time frames
- Any anticipated recreational growth would follow growth trends for Wyoming over the past 10 years
- For the qualitative analysis, only emissions from Rawlins Field Office BLM administered activities are included. (For the cumulative analysis, emissions calculated by TRC are included for other federal and nonfederal actions throughout the state.)
- Criteria pollutants and HAPs are included in the calculations
- Coal mining activity is 1.2 million tons per year production, and coal activity will cease in the year 2004
- No trona mining activity occurs on Rawlins Field Office BLM land.

Emissions were calculated for the following activities: coalbed natural gas (CBNG), coal mining, lands and realty, livestock grazing, off-highway vehicles (OHV), resource roads, salable minerals, vegetation, fire, and natural gas development. Activities related to weed control, wildlife and fisheries, and wild horses are assumed to be insignificant sources of air emissions.

A qualitative emission comparison approach was selected for this RMP air quality analysis. This approach was used because (1) sufficient specific data were not available on future projects, (2) there was limited time available to complete the analysis, (3) as projects are defined quantitative analysis will be required, and (4) WDEQ-AQD will require demonstration of compliance for any future specific projects. There are limitations associated with this approach. However, given the uncertainties concerning the number, nature, and specific location of future sources and activities, the emission comparison approach is defensible and provides a sound basis for comparing alternatives.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe, or EPA) would review specific air pollutant emissions preconstruction permit applications that examine potential project-specific air quality impacts. As part of these permit reviews (depending on source size), the air quality regulatory agencies could require additional air quality impact analyses or mitigation measures. Thus, before development occurred, additional site-specific air quality analyses would be performed to ensure protection of air quality. Federal land managers would require a demonstration that potential impacts from proposed projects would not adversely impact AQRV (including visibility) in sensitive Class I and Class II areas.

Emissions Calculations

Emissions for All Activities Except Fire

Summary emission inventories for each of the BLM activities for the base year short-term and long-term scenarios for all of the alternatives are found in Chapter 4.2, Air Quality Impact Assessment. These emissions were calculated from data provided by the Rawlins Field Office and used best available information, BACT, AP-42, and the emission studies from other BLM documents.

The numbers of oil and gas wells estimated are provided by the Rawlins Field Office and are shown in Table A4-4. (This table accounts for net wells in operation and subtracts wells that are abandoned.)

Table A4-4. Numbers of Oil and Gas Wells for the Rawlins Field Office

Well Type	Existing Wells Through 2003	2008 Operational Wells	2023 Operational Wells
No Action Alternative			
Coalbed Natural Gas (development)	62	943	3586
Coalbed Natural Gas (exploratory)	7	94	355
Total CBNG Wells	**69**	**1037**	**3941**
Natural Gas (development)	2439	3150	5285
Natural Gas (exploratory)	182	253	463
Total Conventional Gas Wells	**2621**	**3403**	**5748**
Total Combined Wells	**2690**	**4440**	**9689**
Alternative 2			
Coalbed Natural Gas (development)	62	989	3769
Coalbed Natural Gas (exploratory)	7	99	374
Total CBNG Wells	**69**	**1088**	**4143**
Natural Gas (development)	2439	3180	5404
Natural Gas (exploratory)	182	275	544
Total Conventional Gas Wells	**2621**	**3455**	**5948**
Total Combined Wells	**2690**	**4543**	**10091**
Alternative 3			
Coalbed Natural Gas (development)	62	758	2843
Coalbed Natural Gas (exploratory)	7	76	282
Total CBNG Wells	**69**	**834**	**3125**
Natural Gas (development)	2439	2952	4487
Natural Gas (exploratory)	182	251	464
Total Conventional Gas Wells	**2621**	**3203**	**4951**
Total Combined Wells	**2690**	**4037**	**8076**
Alternative 4			
Coalbed Natural Gas (development)	62	907	3474
Coalbed Natural Gas (exploratory)	7	108	416
Total CBNG Wells	**69**	**1015**	**3890**
Natural Gas (development)	2439	3127	5255
Natural Gas (exploratory)	182	251	470
Total Conventional Gas Wells	**2621**	**3378**	**5725**
Total Combined Wells	**2690**	**4393**	**9615**

Using the well numbers, individual tables of air emissions for all BLM activities were calculated in linked spreadsheets. These spreadsheets are available on an emissions CD.

Because oil and gas field activities consist of many phases (i.e., exploration, development, production, and closure), the components that need to be included in emission calculations are complex. To understand the elements and assumptions used in the emissions calculations in the emissions CD, the following summary is provided.

Table of Contents for Emissions CD

A list of the detailed spreadsheets, including a short description of some of the spreadsheets, is included below. (A brief description of the contents is included in the first several titles of natural gas development to provide a roadmap of the titles for the other resource areas.) In addition, a gas process flow diagram is included as a pdf file in the emissions CD.

Conventional Natural Gas—Exploratory, Development, and Operations

- Table ZZ—major oil and gas assumptions
- Assumptions—secondary level of assumptions
- Compressor Horsepower (HP) Estimates
- ng-pad const.-fug dust (conventional natural gas fugitive dust from construction)
- Well Field Gas Charac (well field gas characteristics)
- ng-pad const.-exh &flare-shrt (conventional natural gas construction traffic exhaust and flaring short term)
- ng-pad const.-exh &flare-long (conventional natural gas construction traffic exhaust and flaring long term)
- ng-commuting veh-fug dust-shrt (conventional natural gas fugitive dust from commuting vehicles short term)
- ng-commuting veh-fug dust-long
- ng-commuting veh-exhaust-shrt
- ng-commuting veh-exhaust-long
- ng-Operations-NG compress-shrt (natural gas operations compressors short term)
- ng-Operations-NG compress-long
- ng-Op NG Dehyd&Flash&Flare (VOC emissions natural gas operations dehydrators, flashing and flaring)
- ng-Ops-Dehyd&Sep-Heaters-shrt&long (natural gas operations dehydrator and separators heaters)
- ng-Ops-sta. vis-dust&exh-short (natural gas operation station visits vehicular emission short term)
- ng-Ops-sta. vis-dust&exh-long (natural gas operation station visits vehicular emission long term)
- ng-Ops-WO-dust&exh-short (natural gas well operations vehicle dust and exhaust short term)
- ng-Ops-WO-dust&exh-long2
- ng-Ops W&P vis-dust&exh-shrt (well and pipe station visits vehicular emissions)
- ng-Ops W&P vis-dust&exh-long
- ng-Road maint-dust&exh-shrt (road maintenance vehicular dust and exhaust short term)
- ng-Road maint-dust&exh-long
- ng-Comp maint-dust&exh-short (compressor maintenance vehicular dust and exhaust short term)
- ng-Comp maint-dust&exh-long
- Tanks-Condensate&Loadout (emissions from tanks and truck loadout)
- ng-summary-criteria-short (summary of all natural gas emissions short term)
- Annual Summary 2008

- Annual Summary 2023
- ng-summary-criteria-long
- (Same analysis and tabs for Base Year as above for 2003).

Coalbed Natural Gas—Exploratory, Development, and Operations

- Table ZZ—major oil and gas assumptions
- Assumptions—secondary level of assumptions
- Compressor Horsepower (HP) Estimates
- cbng-pad const.-fug dust
- cbng Well Field Gas Charac-(well field gas characterisitics)
- cbng-pad const. traffic-exh-shrt (Heavy equipment and traffic exhaust short term)
- cbng-pad const. traffic-exh-long
- cbng-commuting veh-fug dust-shrt
- cbng-commuting veh-fug dust-long
- cbng-commuting veh-exhaust-shrt
- cbng-commuting veh-exhaust-long
- cbng-operations-NG compress-shrt
- cbng-operations-NG compress-long
- cbng Dehyd shrt&long-(dehydrators short and long term emissions)
- cbng-Ops-Sep-shrt&long (coalbed natural gas operational separators)
- cbng-Ops-sta. visits-dust&exh-short
- cbng-Ops-sta. visits-dust&exh-long
- cbng-Ops-WO-dust&exh-short
- cbng-Ops-WO-dust&exh-long
- cbng-Ops W&P vis-dust&exh-shrt- (well and pipe visits fugitive and vehicular emissions)
- cbng-Ops W&P vis-dust&exh-long
- cbng-Road maint-dust&exh-shrt
- cbng-Road maint-dust&exh-long
- cbng-Compress maint-dust&exh-short
- cbng-Compress maint-dust&exh-long
- CBNG Water Reinjection (Coalbed Natural gas water reinjection pumps short and long)
- cbng-summary-criteria-short
- Annual NG Emissions 2008
- Annual NG Emissions 2023
- cbng-summary-criteria-long
- (same analyis and tabs for Base Year 2003 as above).

Coal Development

- Coal emissions

Lands and Realty

- L&R-heavyequip-dust-shrt&long
- L&R-heavyequip-exh-shrt&long
- L&R-Commuting-FugDust-short
- L&R-Commuting-FugDust-long
- L&R-Commuting-exhaust-short
- L&R-Commuting-exhaust-long
- Summary-short

- Summary-long.

Livestock Grazing

- LG-heavyequip-dust-shrt&long
- LG-heavyequip-exh-shrt&long
- LG-Commuting-FugDust-shortunpav
- LG-Commuting-FugDust-shortpaved
- LG-Commuting-FugDust-longunpav
- LG-Commuting-FugDust-longpaved
- LG-Commuting-exhaust-short
- LG-Commuting-exhaust-long
- Summary-short
- Summary-long.

Off-Highway Vehicles

- ATVs
- OH Motorcycles
- Snowmobiles
- OHV-Summary.

Resource Roads

- res road-dust&exh-short
- res road-dust&exh-long.

Salable Minerals

- sg-dry,hand,screen,load,etc.
- sg-unpaved roads
- sg-batchdrop
- heavy equipment-all operations
- gran-crush,screen,tx,etc
- gran-unpaved roads
- granite-batchdrop
- lime-crush,screen,tx,etc
- lime-unpaved roads
- limestone-batchdrop
- saleable-summary.

Vegetation

- Veg-heavyequip-dust-shrt&long
- Veg-heavyequip-exh-shrt&long
- Veg-Commuting-FugDust-short
- Veg-Commuting-FugDust-long
- Veg-Commuting-exhaust-short
- Veg-Commuting-exhaust-long
- Summary-short
- Summary-long.

The tables are linked spreadsheets with emissions calculations for short-term and long-term time frames. Each set of calculations for the non-oil and non-gas spreadsheets is cumulative, that is, the total emissions for all activities are cumulative for 5 and 20 years, respectively. The beginning of each spreadsheet identifies the emission factors and activity factors, in tabular format.

The detailed emissions tables identified above are on an emissions CD and are available by request from Susan Caplan.

Prescribed Fire Emissions Estimation

To estimate the total emissions of particulate matter and carbon monoxide from prescribed fires, the Simple Approach Smoke Estimation Model (SASEM) was used. SASEM is a simple screening-level Gaussian dispersion model designed to predict ground-level particulate matter impacts from a single source (fire) in generally flat terrain for the western United States.

When available, site-specific information provided by the Rawlins Field Office was used as input to the model. When such information was not available, either built-in model defaults or professional judgment was used to supply missing data.

A total of three scenarios were run according to the information provided by the Rawlins Field Office for Alternative 1. These are as follows:

- **Fire RFA**. Wildland/Urban Interface; five 20-acre treatments; total of 300 tons burned
- **Timber Harvest Residue**. Ten 10-acre burns, total of 160 tons burned
- **Vegetation RFA**. 4,000 acres per year of prescribed fire treatments.

It should be noted that the emission production module of SASEM was used only to estimate total emissions for each event as input to the qualitative air quality assessment. (See references in Chapter 4, Sestak and Riebau 1988.) The detailed results for these model runs are available from Susan Caplan (contact information provided above).

Rawlins RMPPA BLM Emissions

Tables A4-5 through A4-7 show summaries of total BLM emissions, estimated for the base year (2003), the short-term (2008), and the long-term (2023). The tables are broken down by activity and show emissions for the time frame referenced (i.e., base year, short-term, and long-term). Emissions are calculated on an annual basis (tons per year). In addition, for both the short-term and the long-term time frames (Tables A4-6 and A4-7, respectively), emissions were calculated for each alternative. (Because the base year is the same for all alternatives, only one set of base year emissions was needed.) These tables were used to generate the summary tables and figures presented in Chapter 4.

Table A4-5. Base Year (2003) Emissions Inventory for BLM-Administered Lands Within RMPPA (tons per year) Base Case

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NO_x Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons [b]
Coalbed Natural Gas	137	27	125	5	99	52	8
Coal Mining	32	32 [a]	41	5	72	4	0
Lands and Realty	44	7	2	0	1	0	0
Livestock Grazing	52	8	3	0	3	1	0
OHV	4	4	2	0	256	135	14
Resource Roads	2	0	1	0	0	0	0
Salable Minerals	762	200	0	0	0	0	0
Vegetation	9	1	0	0	0	0	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1120	401	47	5	330	139	14
Conventional Natural Gas	594	195	3,060	51	1,632	13,564	1,407
Total Base Year 2003	**1,851**	**623**	**3,232**	**61**	**2,061**	**13,755**	**1,429**

[a] $PM_{2.5}$ assumed = PM_{10} for this activity. Coal mining will cease after 2004

[b] HAP assumed = VOC × 0.1 for non-gas activities

Table A4-6. Short-Term (2008) Emissions Inventory for BLM-Administered Lands Within RMPPA (tons per year)

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO_2 Tons	CO Tons	VOC Tons	HAPs Tons [b]
Alternative 1 (No Action Alternative)							
Coalbed Natural Gas	536	137	1,313	24	1,406	791	120
Coal Mining	0	0 [a]	0	0	0	0	0
Lands and Realty	44	7	2	0	1	0	0
Livestock Grazing	52	8	3	0	3	1	0
OHV	7	7	3	0	574	209	21
Resource Roads	2	0.1	1	0.1	0.2	0.05	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1100	374	10	1	581	211	0
Conventional Natural Gas	734	247	4,137	65	2,148	17,584	1825
Total Short Term	**2,370**	**758**	**5,460**	**90**	**4,135**	**18,586**	**1,966**
Alternative 2							
Coalbed Natural Gas	564	144	1,382	26	1,480	833	126
Coal Mining	0	0 [a]	0	0	0	0	0

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO_2 Tons	CO Tons	VOC Tons	HAPs Tons
Lands and Realty	44	7	2	0	1	0	0
Livestock Grazing	52	8	3	0	3	1	0
OHV	7	7	3	0	574	209	21
Resource Roads	2	0	1	0	0	0	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1100	374	10	1	581	211	0
Conventional Natural Gas	763	256	4,280	67	2,206	18,080	1,876
Total Short Term	**2427**	**774**	**5672**	**94**	**4267**	**19,124**	**2,023**
Alternative 3							
Coalbed Natural Gas	424	109	1040	19	1112	626	95
Coal Mining	0	0 [a]	0	0	0	0	0
Lands and Realty	44	7	2	0	1	0	0
Livestock Grazing	52	8	3	0	3	1	0
OHV	7	7	3	0	574	209	21
Resource Roads	2	0	1	0	0	0	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1100	374	10	1	581	211	0
Conventional Natural Gas	616	213	3596	54	1933	14,871	1549
Total Short Term	**2140**	**696**	**4646**	**74**	**3626**	**15,708**	**1665**
Alternative 4							
Coalbed Natural Gas	530	136	1,298	24	1,391	783	118
Coal Mining	0	0 [a]	0	0	0	0	0
Lands and Realty	44	7	2	0	1	0	0
Livestock Grazing	52	8	3	0	3	1	0
OHV	7	7	3	0	574	209	21
Resource Roads	2	0	1	0	0	0	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1100	374	10	1	581	211	0
Conventional Natural Gas	632	222	3,747	55	2,038	17,357	1,802
Total Short Term	**2,262**	**732**	**5,055**	**80**	**4,010**	**18,351**	**1,941**

a $PM_{2.5}$ assumed = PM_{10} for this activity. Coal mining will cease after 2004

b HAP assumed = VOC $\times$ 0.1 for non-gas activities

Table A4-7. Long-Term (2023) Emissions Inventory for BLM-Administered Lands Within RMPPA (tons per year)

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons [b]
Alternative 1 (No Action Alternative)							
Coalbed Natural Gas	877	324	4,648	47	5,427	3,084	470
Coal Mining	0	0 [a]	0	0	0	0	0
Lands and Realty	61	9	4	0	2	1	0
Livestock Grazing	47	7	3	0	3	1	0
OHV	11	11	5	0	889	326	33
Resource Roads	2	0.1	1	0.12	0.2	0.05	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1117	378	14	1	898	329	33
Conventional Natural Gas	904	318	5,502	77	3,169	17,451	1,847
Total Long Term	**2,898**	**1,020**	**10,164**	**125**	**9,494**	**20,864**	**2,350**
Alternative 2							
Coalbed Natural Gas	922	341	4,892	49	5,712	3,246	495
Coal Mining	0	0 [a]	0	0	0	0	0
Lands and Realty	61	9	4	0	2	1	1
Livestock Grazing	47	7	3	0	3	1	0
OHV	11	11	5	0	889	326	33
Resource Roads	2	0	1	0	0	0	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1117	378	14	1	898	329	34
Conventional Natural Gas	944	333	5,759	80	3,307	19,028	2009
Total Long Term	**2,983**	**1,052**	**10,665**	**130**	**9,917**	**22,603**	**2538**
Alternative 3							
Coalbed Natural Gas	692	256	3,672	37	4,287	2,438	371
Coal Mining	0	0 [a]	0	0	0	0	0
Lands and Realty	61	9	4	0	2	1	0
Livestock Grazing	47	7	3	0	3	1	0
OHV	11	11	5	0	889	326	33
Resource Roads	2	0	1	0	0	0	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1117	378	14	1	898	329	33
Conventional Natural Gas	741	264	4,592	63	2,682	13,719	1,459

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Total Long Term	**2,550**	**898**	**8,278**	**101**	**7,867**	**16,486**	**1,863**
Alternative 4							
Coalbed Natural Gas	867	320	4,602	46	5,374	3,054	466
Coal Mining	0	0 [a]	0	0	0	0	0
Lands and Realty	61	9	4	0	2	1	0
Livestock Grazing	47	7	3	0	3	1	0
OHV	11	11	5	0	889	326	33
Resource Roads	2	0	1	0	0	0	0
Salable Minerals	762	200	NA	NA	NA	NA	NA
Vegetation	64	10	2	0	3	1	0
Fire	170	142	0	0	0	0	0
Subtotal: Other Activities	1117	378	14	1	898	329	33
Conventional Natural Gas	801	293	5,116	67	3,062	16,957	1,797
Total Long Term	**2,785**	**991**	**9,732**	**114**	**9,334**	**20,340**	**2,296**

[a] $PM_{2.5}$ assumed = PM_{10} for this activity. Coal mining will cease after 2004

[b] HAP assumed = VOC × 0.1 for non-gas activities

RESULTS OF IMPACT ANALYSIS

Table A4-8 summarizes the existing conditions described in Chapter 3, Affected Environmental (Air Quality).

Table A4-8. Existing Conditions

Air Quality Value Air Pollutant Concentrations	
Criteria Air Pollutants	**Concentrations** Base year: in compliance with NAAQS and WAAQS
Visibility (Rocky Mountain National Park [RMNP] and Centennial)	
Visual Range	**20% cleanest**: Base year 150–173 miles (RMNP) and 178 (Centennial 2001) **Average:** Base year 112–126 miles (RMNP) and 117 (Centennial 2001) **20% haziest:** Base year 71–88 miles (RMNP) and 81 Centennial 2001) **Visibility Guidelines** Base year: Within guidelines
Atmospheric Deposition (Centennial, Wyoming)	
Precipitation pH	Base year: 4.9–5.2
Total Deposition	**Total nitrogen deposition**[a] Base year: 4.3 kg/ha/year **Total sulfur deposition**[b] Base year: 2.5 kg/ha/year **Total nitrogen deposition guidelines** Base year: Not within guidelines 1999: otherwise, within **Total sulfur deposition guidelines** Base year: Within guidelines

Air Quality Value
Air Pollutant Concentrations

[a] Proposed acceptable total annual loading nitrogen deposition is 3 to 5 kg/ha/year (USFS 1989)
[b]Proposed acceptable total annual loading sulfur deposition is 5 kg/ha/year (USFS 1989)

The emission inventory results and qualitative impacts for the alternatives are included in Chapter 4.2, Air Quality Assessment, and total emissions are shown in Table A4-9. Table A4-10 shows the increases in emissions from alternative to alternative, and year to year.

Table A4-9. Total Emissions for Alternatives (tons per year)

Alternative	2003	2008	2023
Alternative 1 (No Action Alternative)	20,960	30,641	43,545
Alternative 2	20,960	31,585	46,298
Alternative 3	20,960	26,194	35,282
Alternative 4	20,960	29,758	42,305

Note: Totals are all pollutants minus $PM_{2.5}$ and HAPs

Table A4-10. Increase in Annual Air Emissions from Base Year Conditions on BLM-Administered Lands Within the RMPPA[a]

Time Frame	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOC	HAP
Alternative 1 (No Action Alternative)							
2008	519 (28%)	135 (22%)	2,228 (69%)	29 (48%)	2,074 (101%)	4,831 (35%)	537 (38%)
2023	1,047 (57%)	397 (64%)	6,932 (214%)	64 (105%)	7,433 (361%)	7,109 (52%)	921 (64%)
Alternative 2							
2008	576 (31%)	151 (24%)	2,440 (76%)	33 (54%)	2,206 (107%)	5,369 (39%)	594 (42%)
2023	1,132 (61%)	429 (69%)	7,433 (230%)	69 (113%)	7,856 (381%)	8,848 (64%)	1,109 (78%)
Alternative 3							
2008	289 (16%)	73 (12%)	1414 (44%)	13 (21%)	1,575 (76%)	1953 (14%)	236 (17%)
2023	699 (38%)	275 (44%)	5,046 (156%)	40 (66%)	5,806 (282%)	2431 (20%)	434 (30%)
Alternative 4							
2008	411 (22%)	109 (17%)	1,823 (56%)	19 (31%)	1,949 (95%)	4,596 (33%)	512 (36%)
2023	934 (50%)	368 (59%)	6,500 (201%)	53 (87%)	7,273 (353%)	6,585 (48%)	867 (61%)

[a] Constituents increase in tons per year and (in percentage change from base year emissions)

OTHER EMISSIONS DATA

Although only BLM activities were included in the qualitative analysis, other emissions data are being developed for areas that include the Rawlins District. These data were provided by TRC Environmental Corp (TRC, 2004), using State of Wyoming air permit information and other information, including all potential (PTE) and some actual emissions for point sources throughout Wyoming that were permitted between January 1, 2001, and June 30, 2003. Tables A4-11 and A4-12 show the calculations of the incremental increase (i.e., change from the base year) in emissions from January 1, 2001 (the base year), through June 30, 2003, for permitted sources.

The Wyoming statewide emission inventory conducted by TRC indicates that there will be a change in future emissions of NO_x, SO_2, PM_{10}, and $PM_{2.5}$ in the RMPPA and for the State of Wyoming. This study uses different base year dates. The Wyoming statewide complete emissions increases (or decreases) were calculated (1) from all permitted sources, from January 1, 2001, through June 30, 2003; (2) all new oil and gas commission sources from 2002; and (3) all NEPA authorized and other quantifiable emissions from June 30, 2003. (This last case is referred to as the Wyoming statewide Reasonable Forseable Development [RFD]). It should be noted that not all emissions permitted or authorized during this period are occurring yet.

The RFD case refers only to oil and gas projects and covers the change in emissions after June 30, 2003, for authorized NEPA and other quantifiable emissions. (Specifically, the RFD case is defined by TRC as "…1) the NEPA-authorized but not yet developed portions of the Wyoming NEPA projects and 2) not yet authorized NEPA projects for which air quality analyses were in progress and for which emissions had been quantified.)" Also, complete (total) emissions are calculated. Table A4-12 shows these emissions. It is expected that these data will someday be integrated with the BLM emissions data to depict all emissions in the Rawlins District and can be used for cumulative analysis. Also, this information will be needed if air dispersion modeling is performed in the area.

Table A4-11. Incremental Emissions From Permitted Sources, January 2001 through June 2003, for the RMPPA

	WDEQ-AQD Permitted Sources Change In Emissions (tpy)				WOGCC Permitted Oil and Gas Wells[a] Change In Emissions (tpy)			
Area	NO_X	SO_2	PM_{10}	$PM_{2.5}$	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Rawlins FO[b]	281	(1,002)	(49)	(49)	9.5	--	--	--
Wyoming	20,344	(85)	(1,812)	(1,539)	150.9	--	--	--

[a] Emission factors per well were assumed according to the following: 0.045 tons per year (tpy) of NO_x per producing natural gas or coalbed natural gas well, equivalent to well emission rates calculated for the Jonah Infill Project, 2004, and 0.3 tpy NO_x per producing oil well (obtained from Denise Kohtala, WDEQ-AQD).
[b] Permitted oil and gas wells category includes Carbon, Albany, and Laramie counties.

Table A4-12. RFD and Complete Emissions for the RMPPA[a]

	RFD[b] Change In Emissions (tpy)				Complete Inventory Change In Emissions (tpy)			
Area	NO_X	SO_2	PM_{10}	$PM_{2.5}$	NO_X	SO_2	PM_{10}	$PM_{2.5}$
Rawlins FO[c]	1,147	0	6.8	6.8	1,438	(1,002)	(43)	(43)
Wyoming	6,016	115	741	195	26,510	30	(1,072)	(1,343)

[a] Emission factors per well were assumed according to the following: 0.045 tpy of NO_x per producing natural gas or coalbed natural gas well, equivalent to well emission rates calculated for the Jonah Infill Project, 2004, and 0.3 tpy NO_x per producing oil well, obtained from Denise Kohtala, WDEQ-AQD.
[b] RFD defined as authorized NEPA projects and NEPA projects not yet authorized but for which air emissions have been quantified.
[c] Permitted oil and gas wells category includes Carbon, Albany, and Laramie counties.

The data in Table A4-11 indicate that permitted sources from January 1, 2001, through June 30, 2003, have contributed additional NO_x emissions of 281 tons per year and that emissions of other pollutants were reduced for the RMPPA. However, because the base year for the emissions calculations for the

Rawlins RMPPA is for 2003, the RFD values in Table A4-12 are more appropriate for comparison of cumulative impact. In Table A4-12, the RFD NO_x emissions for the Rawlins Field Office are about one-half the NO_x calculated for the RMP (see Table A4-10) for the short term and about one-sixth of the emission differences projected for the long term (see tables above for comparisons). The RFD values for the State of Wyoming are a little less than long-term BLM RMP emissions, except for particulates. (This is to be expected because much of the BLM RMP particulate emissions sources, such as construction activities, do not require a permit.)

CONCLUSIONS AND RECOMMENDATIONS

A qualitative emission comparison approach was selected for analysis of impacts on air quality. This approach was used because (1) sufficient specific data were not available on future projects, (2) there was limited time available to complete the analysis, (3) quantitative analysis will be required as development projects are defined in the future, and (4) WDEQ-AQD will require demonstration of compliance with federal and state air quality regulations and standards for any future development projects. Given the uncertainties regarding the number, nature, and specific location of future emission sources and activities, the emission comparison approach is defensible and provides a sound basis for comparing the potential impacts under the various alternatives. Federal land managers will require a demonstration that potential impacts from proposed projects will not adversely impact AQRV (including visibility) in sensitive Class I and Class II areas.

For the RMP-specific air quality analysis, the BLM concludes the following:

Under Alternative 1, emissions have been calculated for the base year and for 5-year and 20-year time horizons. These will serve as the basis for comparisons of alternatives. Information in Tables A4-7 through A4-9 indicates that the total emissions of criteria pollutants increase from 20,960 tons per year in the base year (2003) to 43,545 tons per year by 2023. Most of the increase is due to oil and gas exploration and development. Alternative 2 produces higher emissions than Alternative 1 (emissions of 46,298 ton per year in 2023), and Alternative 3 produces lower emissions estimates for 2023 (35,282 tons per year). Alternative 4 produces emission levels between those of Alternatives 2 and 3 (42,305 tons per year).

Given the low ambient concentrations that exist in the Rawlins area for all of the pollutants except ozone, it is expected that the increase in emissions, under any alternative, of carbon monoxide (CO), nitrogen oxides (NO_2), sulfur dioxide (SO_2), PM_{10}, and $PM_{2.5}$ will not cause any exceedance of state or federal ambient air quality standards. Because a quantitative relationship between the expected air emissions calculated above and the subsequent potential impacts on ambient criteria pollutant concentrations, visibility, atmospheric deposition, or ozone are not known, it is not possible to draw any conclusions as to potential expected impacts on these air quality values from any alternative. BLM intends to make quantitative estimates of these impacts for project-specific EISs and in the statewide air quality analysis.

For the cumulative analysis, BLM concludes the following:

Given the low ambient concentrations that exist in the Rawlins RMPPA for criteria pollutants except ozone, it is expected that the cumulative increase in emissions for all of sources in the region of influence (ROI) of carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), PM_{10}, and $PM_{2.5}$ would not cause any exceedance of state or federal ambient air quality standards.

Because a quantitative relationship between the expected air emissions calculated above and the subsequent potential cumulative impacts on the air quality values of visibility, atmospheric deposition, or ozone are not known, it is not possible to quantify potential impacts on these air quality values from the sources in the ROI. However, because air quality analyses from recent energy development projects, such as the Desolation Flats project (BLM 2003), estimate potential impacts on visibility, the possibility that the emissions described in Section 4.2 may contribute to significant impacts on visibility must be considered. Results of a quantitative analysis using modeling performed for the Desolation Flats EIS suggest that RMPPA activities could contribute to a significant impact on visibility in the Bridger, Fitzpatrick, Mount Zirkel, and Rawah WAs.

In addition to these findings, monitoring of total nitrogen deposition in the Snowy Range shows deposition loading above the Forest Service LOC. Accordingly, emissions described in Section 4.2 may contribute to significant impacts on total nitrogen deposition. BLM intends to make quantitative estimates of these impacts for project-specific EISs and in the statewide air quality analysis.

Given the qualitative nature of the emission comparison approach, it is recommended that the following actions be performed:

- A more sophisticated air quality set of tools should be considered for future analysis of specific projects (i.e., modeling)
- Additional monitoring for ambient criteria pollutants, visibility, and atmospheric deposition should be conducted in the area.
- Mitigation measures, such as those discussed in this AQTSD, should be considered. Some of these measures include dust suppression and control during construction, electric power generation for natural gas compressor engines, flareless completion, and natural gas compressor engine nitrogen oxide controls.

INTERNET RESOURCES

Numerous Internet resources were accessed to develop the data used in this document. Key information concerning emission factors and emissions was obtained from EPA Web sites.

Climate

Western Regional Climate Center:http://www.wrcc.sage.dri.edu/climsum.html/

NOAA: http://www.noaa.gov

Stagnation Index: http://www.ncdc.noaa.gov/oa/climate/research/stagnation/stagnation.html

Air Quality: Emissions

EPA: http://www.epa.gov/ttn/chief/ap42

Air Quality: Concentrations

EPA: http://www.epa.gov/air/data/geosel.html

CASTNet: EPA: http://www.epa.gov/castnet

NPS: http://www2.nature.nps.gov/ard/gas/airatlas-du/viewer_index.htm

BLM: http://www.blm.gov

BLM: http://www.wy.blm.gov

Air Quality: Atmospheric Deposition

NADP: http://nadp.sws.uiuc.edu/

CASTNet: EPA: http://www.epa.gov/castnet

NPS: http://www2.nature.nps.gov/ard/gas/airatlas-du/viewer_index.htm

Air Quality: Visibility

IMPROVE: http://vista.cira.colostate.edu/improve

IMPROVE: http://vista.cira.colostate.edu/views

FLAG: http://www.WDEQ-AQD.nps.gov/ard/flagfree

Wyoming Visibility Monitoring Network: http://www.wyvisnet.com

MITIGATION OPTIONS

Mitigation may be applied to fugitive dust and NO_x impacts. Fugitive dust refers to any particulate matter that is not deliberately emitted by a well-defined source. Fugitive dust sources typically include windblown dust from unvegetated lands, construction, and unpaved roads. Table A4-13 shows several available fugitive dust mitigation options.

Table A4-13. Fugitive Dust Mitigation Measures (PM_{10}), Effectiveness and Cost

	Dust Sources					
	Disturbed Areas	Unpaved Roads [a,b,c]				
Effectiveness	Level proportional to percentage of land cover	0 to 50% reduction in uncontrolled dust emissions	33% to 100% control efficiency	80% for 15 mph[c] 65% for 20 mph[c] 25% for 30 mph[c]	30% reduction	90% reduction
Estimated Cost	Unknown	$4,000/mile	$2,000 to $4,000/mile per year	Unknown	$9,000/ mile	$11,000 to $60,000/mile

[a]Improved and county roads
[b]Wetting of construction roads during the construction period. Wetting of construction roads not required for once-a-month maintenance trips to well pads.
[c]Reductions assume a 40-mile-per-hour base speed.

Nitrogen oxide emissions are associated with combustion. Table A4-14 shows several potential mitigation measures that could reduce impacts from NO_x emissions. The appropriate level of control will be determined by the WDEQ-AQD during the construction permit process.

Table A4-14. Nitrogen Oxides (NO_x) Mitigation Measures Efficiency

	NO_x Emissions Sources			
	Field Compressors	Sales Compressors	Temporary Diesel Generators[a]	Heavy Equipment
Mitigation Options/Efficiency	Implement Best Available Control Technology Typically results in a NO_x emission rate of about 1 g/bhp-hr	Implement Best Available Control Technology Typically results in a NO_x emission rate of about 1 g/bhp-hr	Register with State; WDEQ regulate as appropriate	Voluntary use of electric engines[b]

[a]Wyoming is currently registering these generators to determine whether NO_x emissions are significant.
[b]BACT could include electric compression.

In addition, Table A4-15 shows additional mitigation measures to be considered in the Rawlins impact assessment. These are general mitigation opportunities that should be considered and applied as appropriate. BLM has no authority to require any application of these measures, although industry is encouraged to implement these measures on its own before it is required to by WDEQ. Advances in technology are likely to offer new mitigation options during the time covered by the RMP. Under NEPA, the planners of individual projects in the RMPPA must recommend mitigation measures that are appropriate for the projects. The Wyoming DEQ, as the permitting authority, will review permit applications and require specific emission control devices and measures. All costs shown in Table A4-15 are approximate.

Table A4-15. Additional Mitigation Measures With Approximate Costs and Benefits

Type of Mitigation	Approximate Cost	Environmental Cost	Potential Limitations	Environmental Benefit
Selective Catalytic Reduction for Compressor Emissions	\$4,000 to \$27,000 per NO_x ton-year	Possible NH_3 releases	Cost may be prohibitive for oil and gas applications	NO_x emission rate reduced to 0.1 g/hp-hr; decreased visibility impact
"Green Completions" and Flowback Units	Capital cost ranges from \$1,000 to \$10,000. Operating cost is \$1,000/year. Payback 1–3 years	Moving equipment to and from well completions; fugitive dust from truck		Saves 100,000 cubic feet of gas per well per year; reduces flaring emissions by 70% to 90% at completion
Condenser on Glycol Dehydrator	\$1,000 to \$10,000	Unknown		1% to 10% VOC reduction
Activated Carbon Filter on Condensate Storage Tank	\$1,000 and up	Energy required to recycle filter		50% to 80% VOC reduction

Type of Mitigation	Approximate Cost	Environmental Cost	Potential Limitations	Environmental Benefit
Electrical Compressors	Capital cost is 40% of gas turbine cost. Operating costs depend on location of transmission lines	Displaced air emissions from compressor unit to electric power plant		Moving air emissions away from sensitive Class I areas
Fugitive Dust Road Treatment	$2,400 to $50,000 per mile	Possible vegetation effects		20% to 100% dust control
Fugitive Dust Administrative Control	$13,000 per well for remote telemetry. A few added work hours per year traveling at enforced speed limits	Minor/unknown	Hard to enforce	Reduced VMTs with related emission reductions. Slower speeds give 20% to 50% reductions in dust emissions
Larger Diameter Sales Pipeline	Capital costs increase with larger pipes. Operating costs decrease with larger pipes	Larger trench for burying line. Slightly more surface disturbance	Probably applicable only for large producing operations	Lower gas pressures with resulting lower compressor emissions
Microhole drilling	Cost of technology transfer, then potentially less than conventional drilling	Additional impacts if duplicate drilling is necessary		Lighter equipment on roads, smaller drilling sites, reduced gaseous emissions during drilling
Condensate Pipelines	Cost of pipe and installation minus cost of eliminated storage tank and trucking	Trench for burying line	Cost may outweigh benefit	Reduce emissions from storage vessels; reduce miles traveled by vacuum trucks
Stage I Vapor Controls for Condensate Transfer for Truck Loading	$1,000 to $3,000	Potential fire risk with improper operation		90% VOC emission reduction during transfer
Wind Farm Electric Generation	4 to 5 cents/kW-hr. Capital costs are large	Visual impacts, impacts on raptors, maintenance	Large capital costs required	Reduced power plant emissions. (VOC, NO_x, SO_2, CO, CO_2)
Phased Oil and Gas Development	Short-term loss of state and federal royalties	Emissions averaged over a longer period		Peak emissions and impacts are reduced

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